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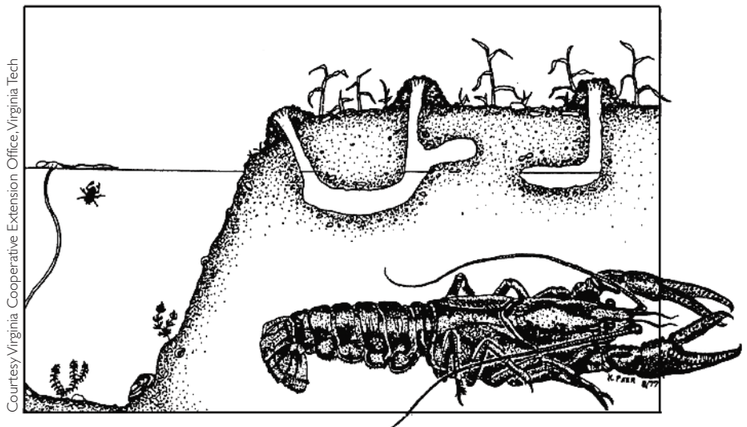
by Beth Hester

I was a city-bred kid. As soon as I was old enough to explore surrounding terrain, I rambled about during visits to my maternal grandparents' small farm in western North Carolina—a free-range child at last. I distinctly remember the moment I became 'crayfish aware', noticing ubiquitous muddy, mica-flecked chimney structures surrounding a central dark opening. I found these weird constructions in the yard near the spring, along the ditch banks, and also near the ponds where my grandfather raised minnows to sell for bait. These mounds fascinated me; I would select one and sit next to it for long periods of time, hoping to catch a glimpse of the mysterious creature that dwelled within.

My grandparents called them 'crawfish' and told me I wouldn't see one in the daytime. They said they looked like miniature lobsters, that they were used for bait, and that their burrows ruined the visual impact of the yard, sometimes eroding portions of the banks. No one they knew trapped them for culinary purposes, as the crawfish were considered scavengers that ate anything and everything, and so couldn't possibly be healthy for human consumption. This puzzled me and seemed contradictory. Miniature lobsters were off limits, but frog legs, bottom-feeding catfish, and various portions of pig were occasionally on the table, right alongside the cat head biscuits and rhubarb jam.

Chris Lukhaup



Courtesy Virginia Cooperative Extension Office, Virginia Tech

Top: a close-up of the mud balls, or chimney, pushed to the surface when a crayfish excavates a burrow. Bottom: illustration of the burrows underground which extend below the water table and can contribute to bank erosion.

Whether you eat them or not (farm-sourced only in Virginia please, as current regulations do not include the trapping of wild crayfish for food), these fascinating invertebrates continue to entertain curious children and provide anglers with prime sources of live bait and fly-tying inspiration. Most importantly, native species of crayfish play a crucial role in the health of freshwater ecosystems. In short, crayfish are remarkable subjects—well worth exploring from multiple perspectives—so let's get started.

Their Role in Aquatic Ecosystems

So much depends upon the crayfish. As a keystone species, the presence of crayfish contributes to the overall health, balance, and biodiversity of our freshwater streams. In Virginia, we have approximately 34 known species of both burrowing and non-burrowing native crayfish (but that number is sure to rise). They form an important link in the food chain, being a major dietary source for trout, bass, and sunfish. Other predators include raccoons, kingfishers, duck varieties, wading birds, otters, mink, the black bear, and last but not least—humans. Over 240 species of wild animals in North America have been found to consume crayfish. In turn, crayfish will dine upon aquatic vegetation and animal matter, living and dead. They are enthusiastic recyclers within an aquatic community's cycle of life and the beneficiaries of photosynthetic activity.

But wait... there's more. It seems that crayfish have a personal beauty secret: They stay clean and snappy-looking thanks to a little help from branchiobdellida, a uniquely adapted worm that is closely related to the leech.

Virginia Tech-based research teams, guided by Associate Professor of Aquatic Ecology Bryan Brown, are currently studying the curious and complex symbiotic behavior that exists between crayfish and said worm in Sinking Creek and in other select Virginia waterways. The studies provide surprising glimpses into observed behavioral patterns not generally associated with crayfish in humble creeks and streams throughout the world, as such behaviors are more commonly linked to exotic locales and the spectacularly improbable pairings of wildlife species that team up for mutual benefit: think crocodiles and plovers in Africa (where the contented plovers serve as crocodile toothpicks) or clownfish and sea anemone partnerships within coral reef communities.

Since all kinds of organisms—bacteria, various protozoa, algae, and small invertebrates—like to hitch rides on the crayfish's exoskeleton, the crayfish need to periodically groom. It also happens that the tiny worms (branchiobdellida) are top predators for all of those organisms, so they attach themselves to the crayfish to dine. James Skelton, a participant in the Virginia Tech studies, puts it this way: "In this stunning example of mutualism, these close relatives of leeches clean their crustacean hosts in exchange for food, shelter, and a place to reproduce."

Courtesy Kevin Geyer, Virginia Tech

Courtesy James Skelton, Virginia Tech

Top, Virginia Tech researchers collect crayfish using a seine net in Sinking Creek. After a visit to the research lab, the crayfish are held in underwater enclosures for further observation and study.

Pictures, and today's YouTube videos, often speak louder than words. To get a good visual of this symbiotic relationship, type the following address into the browser of your computer, tablet, or smart phone and watch the fascinating behavior Skelton managed to capture through both aquaria and microscope: www.youtube.com/watch?v=QHrIRmT_nXQ.

Brown is excited because these studies, part of a National Science Foundation project, demonstrate that unusual symbiotic behaviors are not exotic happenings in some far-off country, but are occurring in our own backyard. The studies are also beginning to show a correlation between the numbers of worms found on the crayfish and the health not only of the crayfish themselves, but of the waterways in which they live. Brown explains, "These worms can have a very positive impact on the growth and mortality of the crayfish when the numbers of worms on the crayfish are in appropriate numbers; for example, the worms are important to older crayfish who groom less. But in nature, relationships are not static. It's more of a sliding scale—and there is always that tipping point where mutualism can devolve into parasitism, and worms in too large numbers can begin to damage the crayfish's gills. In most cases, we are seeing an amazingly self-adjusting system."

Brown and his students obtain the crayfish through seining or hand capture, and then it's off to the lab where preliminary procedures are performed. The crayfish are then transported back into the waterway, where they are placed in enclosures for further study. Brown elaborates, "Our work employs a combination of field experiment, lab experiment, field observational data, and lab observational data. Basically we're tackling the crayfish study from every possible vantage point. In my opinion, the use of multiple approaches makes for better science."

One surprising development: Brown's research is beginning to uncover a difference in the way the branchiobdellida relate to *native* crayfish versus *non-native* invasive species, whose grooming behaviors are different. The worms don't yet seem to recognize the invasive species, or don't yet see them as a threat. Thus, when the worms seek out a new host and make the mistake of latching onto an invasive, they could be walking into a death trap. Brown's investigations have the potential to change the way we understand certain evolutionary behaviors, as well as factors impacting the overall health of freshwater aquatic systems.

Pollution and Invasive Species

Virginia Cooperative Extension experts and Department of Game and Inland Fisheries biologists emphasize that crayfish are very sensitive to their surroundings; healthy native crayfish populations are indicators of optimal water quality. A sudden kill or decline in these

Chris Lukhaup

Big Sandy Crayfish *(Cambarus veteranus),* native to Virginia

Chris Lukhaup

Rusty Crayfish *(Orconectes rusticus),* non-native to Virginia

Chris Lukhaup

Virile Crayfish *(Orconectes virilis),* non-native to Virginia

populations can indicate the introduction of a toxin or the presence of another habitat-degrading influence.

But water pollution isn't the only threat our crayfish face. Across North America, the destruction of physical habitat by multiple means, and the (mostly) accidental introduction of invasive non-native crayfish and other exotic animal species are major causes for concern. Of Virginia's 34 crayfish species, one—the Big Sandy crayfish *(Cambarus veteranus)*—is listed as endangered and is being reviewed for federal status. Another 13 species are currently listed as "Species of Greatest Conservation Need" in the *Virginia Wildlife Action Plan*. Some of those species may be removed from the list as their status is updated. Alternately, some species could get added to the list, as at least two appear to be rare and restricted in their distribution.

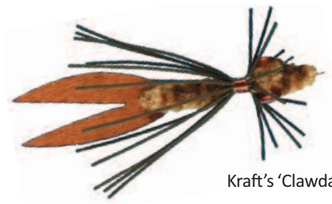
In Virginia as in many states, invasive species of non-native crayfish threaten to crowd out the locals. Specifically, two invasive species—the Rusty crayfish *(Orconectes rusticus)* and the Virile crayfish *(Orconectes virilis)*—have been confirmed in certain Virginia rivers and streams. These non-natives are much larger and are more aggressive than our native varieties, and this is a problem. Brian Watson, an aquatic resources biologist with the Department, elaborates: "Non-native crayfish introductions in Virginia happen primarily through bait bucket introduction, but also through release by aquarium hobbyists. We've also seen the occasional release of non-native crayfish from educational programs. This is how the Red Swamp crayfish was introduced into Guion Pond on the Sweet Briar College campus in Amherst. The sale of live crayfish for bait and for personal use (hobbyists) was banned in Virginia in 2006."

Non-native, invasive crayfish can degrade critical habitat, displace and outcompete native crayfish, attack young game fish and amphibians, and spread disease. What can be done to prevent the introduction or spread of invasive species? **In short, don't dump bait!** If you collect your own crayfish for bait, only take what you need. Never release any remaining live crayfish into waterways. According to Watson, it's not just the introduction of non-native species that is of concern, but also the movement of native species into areas where they do not currently exist.

Fish On! Angling with Crayfish and Their Imitations

Saltwater anglers deploy sand fleas (mole crabs) in pursuit of their quarry. Freshwater anglers turn to the crayfish. Bass, trout, musky, and various panfish love crayfish. Anglers should hook live crayfish lightly through the tail, using a sinker if necessary to get the crayfish close to the bottom, and allow it to drift naturally along with the current. Crayfish are active at night and can be best obtained by using a hand net, or via a specialized trap, although I've seen crayfish brought to hand in the daytime with a hunk of fish and a hand line. Traps similar to those used for minnows can be easily and economically constructed from hardware cloth or half-inch chicken wire mesh with openings of approximately two inches.

Crayfish currently enjoy a surprisingly high profile. A quick stroll through the Internet using the search term 'crayfish traps' will garner a host of innovative trapping ideas and trap configurations, including numerous and often entertaining how-to videos. Some enterprising anglers even construct crayfish traps from large plastic beverage bottles and zip ties. The only limit is your imagination.



Kraft's 'Clawdads'

Courtesy of William Heresniak - Eastern Trophies Fly Fishing

Finally, for fly anglers crayfish provide a platform for extraordinary creativity. Along with other crustacean imitations like shrimp and crabs, crayfish flies can be among the most satisfying to tie. Maybe it's the buggy eyes, flashy tails, articulated claws, and swimmy legs that make tying them so much fun—or maybe it's because the materials one can deploy are so delightfully varied. Crayfish flies can run the gamut, from shockingly realistic replicas that are works of art to mere silhouettes in appropriate color configurations of black, cream, root beer, olive, gold, and various shades of brown. In a pinch, if an actual crayfish fly is not available, anglers often have success with Woolly Bugger variations and with certain shrimp imitations and appropriately colored Crazy Charlies.

The Old Dominion tends to be a breeding ground for innovative fly tying, and several of the most fish-friendly and interesting crayfish patterns come from two Virginians: Chuck Kraft (also a renowned fishing guide), and Harry Murray, guide, author, teacher, and proprietor of Murray's Fly Shop. Kraft's 'Clawdads' sport a unique claw pattern that fly-tiers can use to gain an authentic profile. The Clawdads can be purchased through many of Virginia's independent and reputable fly-fishing shops; alternately, the materials themselves can be ordered to allow for building your own in a range of custom colors.

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Murray, who maintains an ample stock of several crayfish patterns, was kind enough to share his recipe for Murray's Standard Crayfish (see below). ❧

Beth Hester is a writer and freelance photographer from Portsmouth. Her passions include reading, shooting, kayaking, fishing, tying saltwater flies, and tending her herb garden.

Murray's Standard Crayfish©

Murray's Standard Crayfish

MATERIALS

Hook: Mustad 9672 or Tiemco TMC 5262, Sizes 2 through 8
Thread: 3/0 brown Prewaxed Monocord
Shell: Fox squirrel tail
Pinchers: Fox squirrel tail
Body: Tan and olive chenille
Rib: Soft rooster brown neck hackle and Size A Monocord
Tail: Fox squirrel tail
Weight: Lead-free wire

TYING PROCEDURE

- Place the hook in vise. Cover shank with thread. Wind lead-free wire over entire shank and apply cement. Over-wrap with thread.
- Form pinchers by tying in a group of fox squirrel tail fibers by the tips just above the bend. Split apart at a slight angle, and lock into place with tying thread.
- Select a second bunch of fox squirrel tail hairs to form shell and tail. Tie them in by the tips where the pinchers are tied. The butts of this hair should extend beyond the bend of the hook, approximately one inch longer than the shank.
- Tie in the olive chenille for the forward body and the hackle for ribbing over the squirrel tail. Wind the chenille over the rear third of the shank and tie off. Wind the hackle forward in about three or four evenly spaced wraps over the chenille and tie off.
- Cut off excess olive chenille and hackle.
- Tie in tan chenille directly in front of the olive chenille. Tie in a 3-inch piece of brown, Size 'A' Monocord at this same point. Wind the tan chenille forward to ⅛ inch of hook eye and tie off and trim excess.
- Fold squirrel tail shell forward to the hook eye and tie off.
- Make four wraps of ribbing to hold shell down on top where the two chenille colors meet. Wind forward in evenly spaced ribbing wraps over shell, tie off behind eye and trim ribbing.
- Whip finish over top of shell behind the eye and trim thread.
- Spread the shell forward of the hook eye to form the crayfish tail. Trim so it is a half-inch long.
- Whip finish and apply cement.